Additional Storm Water Sampling Work Plan
Terminal 4 Slip 1 Upland Facility
Portland, Oregon

Prepared for:
Port of Portland

August 1, 2012
1267

Ash Creek Associates
A Division of Apex Companies, LLC
APEX

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

Additional Storm Water Sampling Work Plan
Terminal 4 Slip 1 Facility
Portland, Oregon

Prepared for:
Port of Portland

August 1, 2012
1267

REGISTERED
OREGON
MICHAEL J. PICKERING
No. G1932
GEOLOGIST

Michael Pickering, R.G.
Senior Associate Hydrogeologist, Ash Creek Associates

Herbert Clough, P.E.
Principal, Ash Creek Associates

3015 SW First Avenue
Portland, Oregon 97201-4707
(503) 924-4704 Portland
(360) 567-3977 Vancouver
(503) 943-6357 Fax
www.ashcreekassociates.com

Table of Contents

Figures

Appendices

Acronyms and Abbreviations

Ash Creek	Ash Creek Associates, Inc.
BBL	Blasland, Bouck & Lee
BMPs	Best Management Practices
City	City of Portland, Oregon
COPC	Constituent of Potential Concern
DEQ	Oregon Department of Environmental Quality
EE/CA	Engineering Evaluation/Cost Analysis
EPA	U.S. Environmental Protection Agency
Facilities	Terminal 4 Slip 1 and Slip 3 Uplands
JSCS	Joint Source Control Strategy
LWG	Lower Willamette Group
MSL	Mean Sea Level
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PHSS	Portland Harbor Superfund Site
Port	Port of Portland
RI	Remedial Investigation
Stormfilter®	Stormfilter® Treatment System
SW DSR	Storm Water Data Summary Report, Terminal 4 Slip 1 and Slip 3 Upland Facilities
SWE WP	Storm Water Evaluation Work Plan, Terminal 4 Slip 1 and Slip 3 Upland Facilities
SWMP	Storm Water Management Plan
SWSCE	Storm Water Source Control Evaluation
FSPR	Field Sampling Procedures Report
TSS	Total Suspended Solids

1.0 Introduction

This Work Plan presents the proposed additional storm water sampling activities planned at the Port of Portland (Port) Terminal 4 Slip 1 Upland Facility in Portland, Oregon (the Facility). The sampling activities are required by the Oregon Department of Environmental Quality (DEQ), pursuant to the following:

- Terminal 4 Slip 1 Upland Facility – Voluntary Agreement for Remedial Investigation, Source Control Measures, and Feasibility Study (DEQ No. LQVC-NWR-03-18), December 4, 2003.

1.1 Document Organization

This document presents a summary of storm water activities completed to date along with additional proposed source control activities and storm water sampling to be performed in 2012. This document is organized as follows:

- Section 2 provides a background of the Facility, storm water drainage system, storm water controls currently in place, and a summary of the previous investigations.
- Section 3 is a bulleted summary of the historical storm water sampling program, sampling results, and source control evaluation results.
- Section 4 proposed storm water sampling activities.
- Section 5 presents storm water sampling program procedures and analytical program.
- Section 6 presents the proposed reporting.

2.0 Background

This section describes the Facility and storm drain system and summarizes historical storm water sampling results, including information on Terminal 4 Slip 3 Upland Facility. Primary source documents are the Terminal 4 Slip 1 Remedial Investigation (RI) Report (Ash Creek/Newfields, 2007a), the Terminal 4 Early Action Characterization Report (BBL, 2004), and the Terminal 4 Early Action Engineering Evaluation/Cost Analysis (EE/CA; BBL, 2005), as well as operations and environmental maintenance records maintained by the Port.

2.1 Facility Description

Terminal 4 comprises approximately 283 acres on the east bank of the lower Willamette River and is downstream from the St. Johns Bridge in north Portland, Oregon, between River Miles 4.1 and 4.6. The Slip 1 Upland Facility is approximately 98 acres in area. Figures 1 and 2 show the vicinity and layout of the Slip 1 Facility, including the Slip 3 Facility.

The topography of the Slip 1 Uplands is relatively flat, with an elevation of approximately 30 feet above mean sea level (MSL). The ground surface of the Facility is predominantly paved with asphalt or concrete, with unpaved areas of generally gravel or grass. No surface water bodies are located on the Facility, but it is located adjacent to the Willamette River.

2.1.1 Current Facility Use

Terminal 4 has been designated as a marine facility since 1917 and is capable of ship loading and unloading, cargo handling and storage, and has equipment maintenance facilities. The terminal includes three berthing areas (Berths 401, 405, and 408) that are located in Slip 1. Activities at the Slip 1 Upland Facility include areas directly adjacent to Slip 3.

- Slip 1. The Port leases portions of Slip 1 to various industrial tenants. Current tenants include Cereal Food Processors, Inc. (Cereal Foods), Kinder Morgan Bulk Terminal (Kinder Morgan), International Raw Materials, Ltd. (IRM), and Rogers Terminal and Shipping (a division of Cargill Marine and Terminal, Inc.). Cereal Foods leases approximately 2.0 acres and associated structures at Slip 1 for a flouring mill. Kinder Morgan leases Pier 4 and its adjacent area for loading of soda ash onto ships at Berths 410 and 411. IRM leases the liquid bulk facility at Slip 1 for storing, handling, and distributing bulk liquid and granular products. Products handled by IRM have included caustic soda, non-organic fertilizer, magnesium chloride, lignin, lignon-sulfonate, molasses products, tallow, propylene glycol, and vegetable oil. Currently, IRM is handling ammonium sulfate, urea ammonium nitrate (UAN), lignin, propylene glycol, and occasional shipments of sulfate of potash and uses berth 408 to unload these products. Rogers Terminal and Shipping leases office space, warehouse storage, a shop, and a gearlocker.
- Slip 3. A portion of the Slip 3 Uplands is included in the Kinder Morgan soda ash operations, as identified above. Port Marine Facilities Maintenance (MFM) uses the gearlocker building located on the Slip 3 Uplands for storage. The remainder of Slip 3 is either used for parking associated with the Toyota Auto Storage Facility or is currently inactive.

Figure 3 shows the boundaries of the current leaseholds for Slip 1 and Slip 3 Facilities.

2.1.2 Historical Facility Use

The Port prepared a detailed discussion of the history of Terminal 4 (including the Facility) for the EE/CA Work Plan (BBL, 2004) and EE/CA Report (BBL, May 2005). Information on Slip 1 operations, former and current tenants, and substances currently or formerly handled at the Facility are detailed in Appendix A of the EE/CA and summarized below.

The Port acquired certain property and improvements within the Terminal 4 property from the City of Portland Commission of Public Docks (City CPD) effective January 1, 1971. The City CPD purchased the property in 1917 as part of the original 117.55-acre site for the St. Johns terminal. This included approximately 36 acres of submerged land around the former Gatton Slough, which entered the river near the head of Slip 1. Development of the terminal resulted in the filling of Gatton Slough and adjacent areas within the river, and excavation of Slip 1. In 1972, the Port purchased a strip of land along the northern property line from Broadway Holding Company in connection with the relocation of the grain berth to the face of current Berth 401 (Hart Crowser, 1991).

Operations at the Slip 1 Upland Facility during the City CPD's ownership (1917 to 1971) included: loading, unloading, and storage of grain; cold storage; fumigation of cotton and food products; liquid storage (fertilizer, molasses, tallow, urea, caustic soda, and fats); milling of grain into flour, container food freight, a gasoline station, salvage yard, operation of a break-bulk berth and fire boat moorage, and importing ore and ore concentrates, including alumina, bauxite, chromite, chrome ore, coal, ferro-phosphorous iron ore, manganese, lead concentrate, tricaphos, and zinc concentrate.

During the Port's ownership of the Slip 1 Upland Facility, tenant operations have generally included grain storage, milling grain, liquid bulk storage, pencil pitch handling, a soda ash handling facility, and storing and maintaining equipment for loading and unloading ships. The buildings at Pier 1 and Pier 2 have also been used for storage of impounded vehicles from a federal sting operation, architectural artifacts for a local historical group, importing live sheep, and for handling break-bulk cargoes such as steel coil and aluminum ingots.

2.2 Drainage Basins, Storm Water System, and Storm Water Controls

Prior to initiating the storm water sampling program, storm drain drawings were reviewed to identify existing storm drain systems and the drainage basins contributing to the drainage systems present on the Facility as detailed in the DEQ-approved *Storm Water Evaluation Work Plan* (SWE WP; Ash Creek/Newfields, 2007b). Figure 4 shows the basins and drainage systems for the Facility, including the Slip 3 Facility.

2.3 Storm Water Permits, BMPs, and Storm Water Controls

Storm water discharges from the Facilities are permitted under the Port's NPDES DEQ Municipal Separate Storm Sewer System (MS4) Discharge Permit No. 101314 and Kinder Morgan's individual NPDES 1200-Z Industrial Storm Water Permit No. 102446. Kinder Morgan is responsible for legal compliance under its operating agreements, including operational permits, implementation of a Spill Response Plan and a Storm Water Pollution Control Plan (SWPCP), and compliance with the Port's MS4 Discharge Permit. These permits authorize the release of storm water to the river subject to specified terms and conditions and also require the implementation of best management practices (BMPs).

2.3.1 Port BMPs

The Port has implemented numerous BMPs at Terminal 4 as part of its tenant and licensee contracts, Environmental Management System Program, and continual improvement policy. The following is a list of BMPs that are specifically related to activities conducted at Terminal 4 under the Storm Water Management Plan (SWMP) for the NPDES MS4 permit:

- Covered storage, material, and maintenance areas to reduce storm water contact area;
- Waste chemical handling, storage, and disposal procedures to prevent and control spills;
- Regular inspection, cleaning, and maintenance of all materials handling and storage areas and storm water control measures, structures, catch basins and treatment facilities to prevent blocking, accumulations, and discharge of pollutants;
- Annual cleanout of catch basins;
- Deployment and regular maintenance (annual) of catch basin inserts in the following catch basins to prevent sediment loading (Figure 5 shows the location of catch basins with inserts):
  - Basin O – Nos. 5801, 6009, 6011, 6019, 6020, 6022, 6023, and 6024;
  - Basin N – Nos. 6014, 6015, and 6017 (monthly inspection); and
  - Basin Q – Nos. 5792, 6007, 6008, 6025, 6026, 6027, 6029, 6030, 6031, 6032, 6033, and 6034;
- Annual sweeping of impervious areas exposed to storm water to remove any accumulated solids;
- During the Berth 408 Rail Yard Modernization Project, a passive storm water collection system was installed consisting of rock filter areas and perforated high density polyethylene (HDPE) pipe. Storm water is filtered by the rock areas prior to discharging to the perforated pipe, which connects to the storm water system;
- Adherence to published guidance for limiting landscape maintenance impacts to storm water;
- Implementation of a comprehensive Spill Response Program (including a reporting component that provides for immediate action to ensure appropriate and timely spill cleanup and reporting);
- Membership in the City's Regional Spill Committee and the Clean Rivers Cooperative, which are organizations committed to spill prevention and response, and the ongoing protection of maritime environments; and
- Administration of a training program for all affected personnel who play a role in the protection of storm water.

Residuals from catch basin cleanout and street sweeping are managed by the Port MFM personnel. Waste residuals (e.g., catch basin cleanout and street sweeping debris) are collected by MFM and consolidated with similar waste streams from other Port facilities. These wastes are subsequently profiled for waste characterization to determine appropriate treatment or disposal.

Maintenance work on the storm water conveyance system is conducted on a regular basis, including monthly inspections of storm water filtration devices/features and annual maintenance and cleaning of catch basins and drain inlets (last conducted May 2011).

The Port and its tenants implement the terms and conditions of their permits and report annually to the DEQ.

2.3.2 Storm Water Controls

In addition to BMPs employed across the Facility, a Stormfilter® treatment system (Stormfilter) is installed in the conveyance system for Basin M (Figure 6). This system is inspected monthly. The Stormfilter was installed in 2006 as part of the Berth 408 Rail Yard Modernization Project. The Stormfilter is an underground, concrete vault (6 by 12 feet) which houses 11 cartridges that are filled with CSF® Leaf Media. CSF Leaf Media targets the following contaminants: oil and grease, soluble metals, organics, and nutrients. These are the constituents identified by the Port as most likely to be present due to operations following the expansion, and which could contribute adversely to the river. The media works by trapping and adsorbing solids and the above pollutants. Storm runoff comes into the vault through an inlet pipe within the storm system; the vault fills via a flow spreader that disperses the water across the cartridges. The cartridges utilize siphon-actuated filtration. Once water reaches the top of the saturated filter, it drains the filtered water through the bottom of the cartridge and allows the filtered water to move out of the vault and to the outfall.

The treatment vault has a rate treatment capacity of 0.37 cubic feet per second (CFS) compared to the system flow capacity of 5.3 CFS. Excess flow is diverted around the cartridges without treatment. Storm water is directed to the treatment vault by a diversion wall installed in a manhole in the conveyance line to the south of the treatment vault. The diversion wall is low and some water may bypass the treatment vault at flows less than the treatment flow capacity. Figure 6 shows the locations of the sampler, diversion wall, and Stormfilter vault.

2.4 Summary of Storm Water-Related Previous Investigations

2.4.1 Terminal 4 Removal Action Characterization and Recontamination Analysis

The Port completed a Removal Action for sediments at Terminal 4. As part of that process, a Removal Action Characterization was completed (BBL, 2004). Extensive sediment sampling was conducted to define contaminants of potential concern (COPC) in sediments of the river. The COPC identified for Terminal 4 sediments were metals, polycyclic aromatic hydrocarbons (PAHs), bis(2-ethylhexyl)phthalate (DEHP), pesticides (DDT/DDD/DDE), and polychlorinated biphenyls (PCBs).

As part of the removal action, a Recontamination Analysis was deemed necessary to assess ongoing sources that could re-contaminate the river sediments following the removal action. The Recontamination Analysis included storm water sampling. Analytical results from the initial storm water solids sampling were presented and evaluated in the *Draft Recontamination Analysis Report* (BBL, 2006). The 2006 draft recontamination analysis provided the initial analysis approach to support the sediment cleanup design and identified storm water data gaps that would need to be filled to support the final analysis. The storm water data gaps identified included completion of additional storm water sampling at Terminal 4 (see Section 2.4.2 for further information). Based on this additional storm water characterization data and other considerations, a *Sediment Recontamination Analysis Approach Report*, prepared by Formation Environmental (Formation, 2010), was finalized and describes the proposed approach to assess the potential for recontamination of sediments within the Terminal 4 Removal Action area after actions have been implemented. The recontamination analysis will be completed as part of the final sediment remedy design for Terminal 4, currently scheduled after the Portland Harbor Record of Decision (ROD).

2.4.2 2006-2008 Storm Water and Storm Water Solids Sampling and Source Control Evaluation

A storm water characterization program was initiated in December 2006 and included the winter/spring 2007 storm season and the fall 2007/winter 2008 storm season. The storm water characterization program was conducted in general accordance with the DEQ-approved SWE WP dated June 2007, prepared by Ash Creek (Ash Creek/Newfields, 2007b), and the *Rationale for Basin Selection for Storm Water Sampling and Additional Information Requested* by DEQ in the memorandum from Ash Creek to the Port, dated February 26, 2007 (Ash Creek/Newfields, 2007c).

The Terminal 4 storm water characterization program was conducted concurrently with a storm water characterization program conducted by the Lower Willamette Group (LWG) for the Portland Harbor Superfund Site (PHSS) Study Area under U.S. Environmental Protection Agency (EPA) oversight. Methods and procedures used in the LWG study were comparable to the Terminal 4 program so both data sets could be used to assess storm water at the PHSS. Results from the LWG study have been provided to the EPA and partner agencies, and include the Terminal 4 results (LWG's Round 3A and 3B Upland Storm Water Sampling Data Report [September 2008]).

The scope of the sampling program consisted of:

- Storm water sampling from drainage basin conveyance lines for Basins R, Q, M, L, and D. Three storm events satisfying sampling criteria were targeted for sampling during the winter/spring 2007 storm water season. To meeting LWG objectives, the scope was subsequently increased to include an additional fall 2007 storm water event from Basins R, Q, M, L, and D, and three events from Basin D in fall 2007/winter 2008 for PCB analysis.

- Obtaining water level and velocity information from the storm water drainage basin pipes where the composite samplers were deployed.
- Collecting storm water solids samples for analysis from four drainage basin conveyance lines (Basins R, M, L, and D) using sediment traps. Sediment traps were deployed from January 2007 through February 2008 (sample bottles were removed from approximately June through August 2007, during the non-rainy season).

The scope and additional details of the sampling program was described in the *T4 Field Sampling Procedures Report* (FSPR; Ash Creek/Newfields, 2009a).

The results of the storm water characterization were documented in the *Storm Water Data Summary Report*, Terminal 4 Slip 1 and Slip 3 Upland Facilities (SW DSR), dated March 2009 (Ash Creek, 2009b). The evaluation of the storm water and storm water solids sampling results was conducted in accordance with the JSCS guidance (DEQ/EPA, 2007) and DEQ's Guidance for Evaluating the Stormwater Pathway at Upland Sites (DEQ, originally published in 2009; updated in 2010). The purpose of the SWSCE was to assess what, if any, storm water source control measures (SCMs) were needed at the Facilities. The results of the subsequent source control evaluation were presented in the SWSCE Report, submitted to the DEQ on September 9, 2009 (Ash Creek, 2009c). The storm water results from the Terminal 4 sampling were compared with the sampling results in the LWG dataset of other Portland Harbor HI Sites. The SWSCE identified analytes detected in storm water and storm water solids in Terminal 4 samples at concentrations elevated relative to samples collected from other LWG Portland Harbor HI Sites. The majority of those exceedances were in the samples collected from Basins L and M. Therefore, the SWSCE report recommended cleanout of the storm water conveyance lines for Basins L and M in an effort to remove legacy solids from the line.

2.4.3 2010 Storm Water Source Control Measures and Performance Monitoring

To remove legacy solids from the storm water conveyance lines, cleanouts of the storm water conveyance systems for Basins L and M were conducted in June 2010. Because Basins K and N were assumed to be similar to Basin L based on similar land uses, as noted in the SWE WP, the conveyance lines of Basins K and N were also cleaned out.

The storm water conveyance line cleanout SCMs were conducted in general accordance with the DEQ-approved SWSCE report. DEQ commented on the SWSCE in a letter dated December 14, 2009. A response to DEQ comments was submitted by the Port in a letter dated January 29, 2010. The DEQ approved the SWSCE and Port comments in a letter dated March 5, 2010.

Following the cleanouts, three rounds of grab samples were collected between October 2010 and May 2011 from Basins L and M to evaluate the effectiveness of the line cleanouts. The results of the storm water SCMs and subsequent sampling were presented in the *Storm Water Source Control Completion Report* (Ash Creek, 2011). Also included in the report were the results of storm water sampling conducted following tank demolition activities at the Facilities to assess whether the demolition activities impacted storm water.

The results of the 2010-2011 storm water sampling for Basins L and M showed that the storm water line cleanouts successfully removed legacy solids from the conveyance lines. TSS concentrations were significantly reduced in the post-cleanout samples (previously correlated with detected chemical concentrations). Concentrations in storm water from Basins L and M following the line cleanout were generally within the range of detected concentrations in other Portland Harbor Heavy Industrial (HI) sites.

The DEQ and EPA provided comments on the project report and requested additional information regarding the detected concentrations of arsenic and PAHs. The arsenic concentrations increased following the SCM with no known mechanism for the increase. The average concentration of PAHs increased slightly in Basin M following the SCM but decreased an order of magnitude in Basin L. The data collected during the Terminal 4, Slip 1 RI did not identify sources of arsenic or PAHs in surface soil in Basins L or M. In discussions on whether additional source controls or stormwater sampling would be needed, it was agreed that a screening level recontamination analysis would be performed to provide another line of evidence in the evaluation. The Terminal 4 site is unique in the Portland Harbor in that as part of a Removal Action process, EPA on August 6, 2010 approved a recontamination analysis approach (*Sediment Recontamination Approach*, Formation Environmental, 2010).

2.4.4 Screening Level Recontamination Analysis for Storm Water Basins L and M

The *Screening Level Recontamination Analysis for Storm Water Basins L and M* (Formation Environmental, 2012) was conducted following discussion with DEQ and EPA to provide another line of evidence to the results and information presented in the *Storm Water Source Control Completion Report* (Ash Creek, 2011). The recontamination analysis calculations were conducted for arsenic, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene. These specific PAHs were chosen as they were measured at maximum concentrations over two hundred times the JSCS screening level in Basin L stormwater prior to the storm water line cleanouts. These compounds were also the most elevated above screening levels in Basin M stormwater.

The results of the analysis indicated that recontamination of river sediments due to arsenic and PAHs in storm water discharges from basins L and M was not predicted. However, the DEQ and EPA expressed concerns about the assumptions and model parameters.

3.0 Summary of Storm Water Sampling Program

Following is a bulleted summary of the storm water sampling program milestones at Terminal 4 Slip 1 and Slip 3 Facilities.

- A storm water characterization program was conducted from March through September 2007. As described in the Rationale Memo, basins Q, R, L, M, and D were selected for storm water sampling. The smaller, mostly pervious, or inaccessible drainage basins were selected for extrapolation from the basins selected for sampling. Four rounds of samples were collected using composite samplers. Based on the results of the 2006 to 2008 sampling it was concluded that:
    - No additional SCMs were needed for Basins Q, R, and D.
    - The majority of the detected concentrations that were elevated relative to other LWG Portland Harbor HI Sites were in the samples collected from Basins L and M. No apparent constituents were identified in surface soil at the Facilities during the upland RIs that would be impacting storm water. Consequently, a line cleanout of the conveyance systems for Basins L and M (and basins K and N by extrapolation) was recommended to remove legacy solids from the lines.
- The storm water conveyance lines in Basins K, L, M and N were cleaned in June 2010.
- Additional sampling of Basin Q was requested by the DEQ to verify that the grain tank demolition activities had not impacted storm water. The sampling was conducted in October 2010 through May 2011. The results of the 2010-2011 storm water sampling for Basin Q showed that:
    - Storm water was not impacted by the demolition of the grain tanks conducted in 2008.
    - Concentrations of PCBs detected in storm water from Basin Q are equal to or less than the concentrations detected during the original sampling and are within the typical range detected in other Portland Harbor HI Sites.
- Additional sampling of storm water from Basins L and M was conducted in October 2010 through February 2011 to verify the effectiveness of the line cleanouts. Three rounds of samples were collected using grab sampling techniques. The results of the 2010-2011 storm water sampling for Basins L and M showed that:
    - The storm water line cleanouts successfully removed legacy solids from the conveyance lines.
    - The TSS concentrations were significantly reduced in the post-cleanout samples (previously correlated with detected chemical concentrations).
    - Concentrations of chemicals in storm water from Basins L and M following the line cleanout were generally within the typical range detected in other Portland Harbor HI sites. Following review of the SCM report, the DEQ requested additional information regarding the detected concentrations of arsenic and PAHs. The arsenic concentrations increased following the SCM with no known mechanism for the increase. The average concentration of PAHs increased

slightly in Basin M following the SCM but decreased an order of magnitude in Basin L. The data collected during the Terminal 4, Slip 1 RI did not identify sources of arsenic or PAHs in surface soil in Basins L or M.

- DEQ and EPA indicated that additional source control actions were recommended based on the concentrations of PAHs and arsenic in Basins L and M.
  - The DEQ and EPA agreed that a storm water screening level recontamination analysis of Basins L and M should be completed to assess the potential significance of storm water discharge from the Facility. The results of the analysis indicated that recontamination of river sediments due to arsenic and PAHs in storm water discharges from basins L and M was not predicted.

4.0 Proposed 2012 Source Control Measures and Storm Water Sampling Activities

Additional storm water sampling activities are proposed to address concerns presented by the DEQ and EPA regarding recent concentrations of PAHs and arsenic in Basins L and M. This section summarizes the scope of work for the storm water sampling program at the Facilities. The scope of work was developed based on the results of the historical storm water sampling program and an evaluation of current and available BMPs. The Port proposes modifications to the Basin M treatment system with follow-up storm water sampling.

4.1 Basin M Treatment System

The design parameters of the Basin M Stormfilter were reviewed, including discussions with the treatment system vendor. The volume of water directed to the treatment system was designed to coincide with the change in the drainage basin resulting from the 2006 Berth 408 Rail Yard Modernization Project. It appears that the treatment system is capable of treating additional volume and consequently the Port proposes to modify the diversion wall in the conveyance line.

Discussions with the Stormfilter vendor identified a potential issue with the treatment media. The media in use in Basin M (CSF® Leaf Media) may result in increases in PAHs downstream of the filters. The vendor is unsure if the type of media actually releases PAHs or if it is a matrix interference effect. The Port proposes to install different media prior to the start of the wet season.

4.2 Storm Water Sampling Program

Additional storm water samples will be collected to assess current conditions and to evaluate the effectiveness of SCMs and other activities performed at Terminal 4 since the RI data were collected in 2007.

The DEQ and EPA presented various concerns regarding the validity of grab storm water sampling (conducted in the 2010-2011 sampling period). Both grab and composite sampling options are presented in Appendix D of the JSCS guidance. The Port has considered the additional value of composite sampling and plans to utilize this methodology for the proposed sampling. This will provide a direct comparison with the data collected as part of the RI in 2007. Composite samples will be collected from Basins L and M at the same historical sampling points. Two samples are proposed from each basin: one at or near the start of the 2012 wet season (typically mid-October; representing worst case TSS load) and another approximately one month later (more average conditions). The samples will be analyzed for PAHs (total and dissolved), arsenic (total and dissolved), and TSS. Additional details are provided in Section 5 and in the Sampling and Analysis Plan (SAP) in Appendix A.

5.0 Storm Water Sampling and Analysis

5.1 Sampling Event Criteria

Two representative storm events will be sampled: A storm event will be considered representative consistent with the Storm Event Criteria and Selection outlined in the JSCS (DEQ/EPA, 2005), as follows:

- Each sampling event will be preceded by an antecedent dry period of at least 24 hours (as defined by less than 0.1 inch over the previous 24 hours);
- Minimum predicted rainfall volume of greater than 0.2 inch per event; and
- Expected storm event duration of at least 3 hours.

The rain gauge at Terminal 4 (maintained by the City of Portland Hydra Network) was abandoned in the summer of 2011. The rain gauge at Swan Island will be used to determine if the sampling criteria are met. The rain gauge lists the rainfall depth per hour (reported on a 1- to 3-hour time delay). The rain gauge data are found at the following web address: http://or.water.usgs.gov/non-usgs/bes/swan_island_pump.rain.

5.2 Storm Water Sampling and Compositing Procedures

Bulk storm water samples will be collected as composite samples, which comprise a number of discrete individual samples of specific volumes taken at flow-weighted or time-weighted intervals. An automatic composite sampler will be set up with an area velocity flow meter that activates the sampling when there is flow in the pipe. The most common way to collect storm water samples is to use four 1-gallon bottles. The sampler will be programmed with the flow velocity for that specific pipe corresponding to the target rainfall event intensity. The samplers will be programmed to fill individual 1-gallon bottles one at a time. The first bottle would be filled when the target flow is reached. Then, based upon the average storm duration and intensity, the sampler will be programmed to fill the remaining bottles throughout the storm event. The collected storm water from the four 1-gallon bottles will be composited and samples for chemical analysis will be collected from that composite. The storm water samples will be obtained from the same manholes where sampling was historically conducted (Figure 7).

5.2.1 Laboratory Analysis

The samples collected from the above activities will be submitted for the following chemical analyses on a standard turnaround time.

- Total and dissolved PAHs by EPA Method 8270-SIM;
- Total and dissolved arsenic by EPA Method 1632; and
- TSS by SM 2540D.

Additional details are provided in SAP in Appendix A.

6.0 Reporting

Reporting for the storm water sampling program will consist of a Data Summary Report that will include:

- A discussion of the methods and procedures used;
- A summary of storm water event data and conformance with storm event criteria;
- A tabular summary of the analytical results and JSCS screening; and
- Analytical laboratory reports and a quality assurance review.

The data (both as discrete samples and statistical average) will be screened using the relevant JSCS screening levels and the storm water curves for Portland Harbor sites.

7.0 References

Ash Creek/Newfields, 2007a. *Remedial Investigation Report, Terminal 4 Slip 1 Upland Facility.* August 2007.

Ash Creek/Newfields, 2007b. *Storm Water Evaluation Work Plan, Terminal 4 Slip 1 and Slip 3 Upland Facilities.* June 2007.

Ash Creek/Newfields, 2007c. *Memorandum: Rationale for Basin Selection for Storm Water Sampling and Additional Information Requested by Oregon Department of Environmental Quality (DEQ), Portland, Oregon, ACA No. 1267.* February 26 2007.

Ash Creek/Newfields, 2009a. *Field Sampling Procedures Report, Storm Water Sampling Program, Terminal 4 Upland Facility.* February 2009.

Ash Creek/Newfields, 2009b. *Storm Water Data Summary Report, Terminal 4 Slip 1 and Slip 3 Upland Facilities.* March 2009.

Ash Creek, 2009c. *Storm Water Source Control Evaluation, Terminal 4 Slip 1 and Slip 3 Upland Facilities.* September 2009.

Ash Creek, 2011. *Storm Water Source Control Completion Report Terminal 4 Slip 1 and Slip 3 Upland Facilities,* Portland Oregon, September 28, 2011.

Blasland, Bouck & Lee (BBL), 2004. *Terminal 4 Early Action Characterization Report.* September 17, 2004.

BBL, 2005. *Terminal 4 Early Action Engineering Evaluation/Cost Analysis (EE/CA).* May 2005.

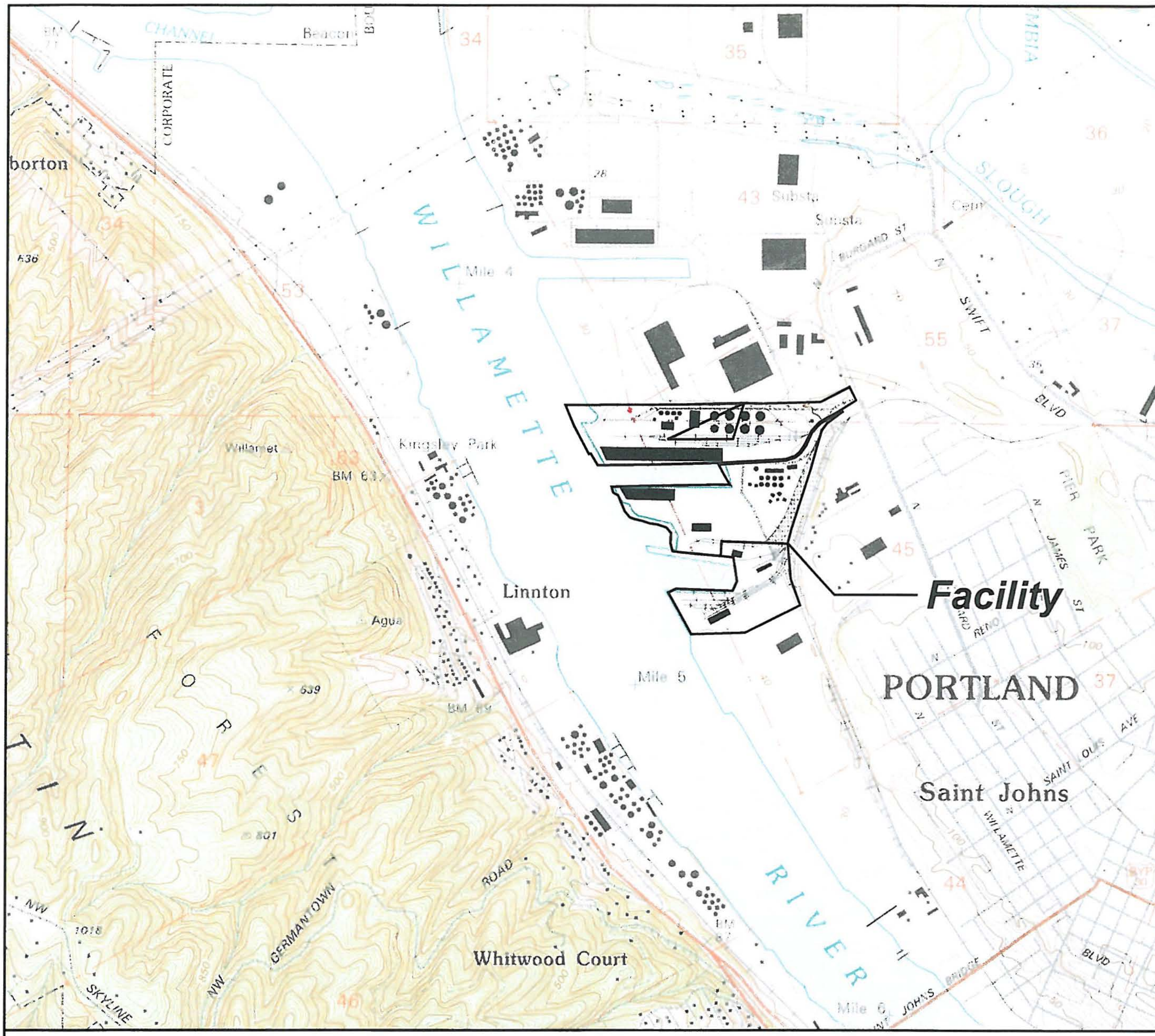
BBL, 2006. *Appendix N – Terminal 4 Recontamination Analysis.* November 2006.

DEQ/EPA, 2005. *Portland Harbor Joint Source Control Strategy, Final.* December 2005 [Table 3-1, 7/16/07 Revision].

DEQ, 2010. *Guidance for Evaluating the Stormwater Pathway at Upland Sites.* January 2009, Updated October 2010.

Formation Environmental, 2010. *Final Sediment Recontamination Analysis Approach, Terminal 4 Removal Action, Port of Portland, Portland, Oregon.* August 12, 2010.

Formation Environmental, 2012. *Screening Level Recontamination Analysis for Storm Water Basins L and M at Terminal 4, Port of Portland, Portland, Oregon.* April 2012.



Base map prepared from the USGS 7.5-minute quadrangle of Linnton, Oregon, dated 1990.

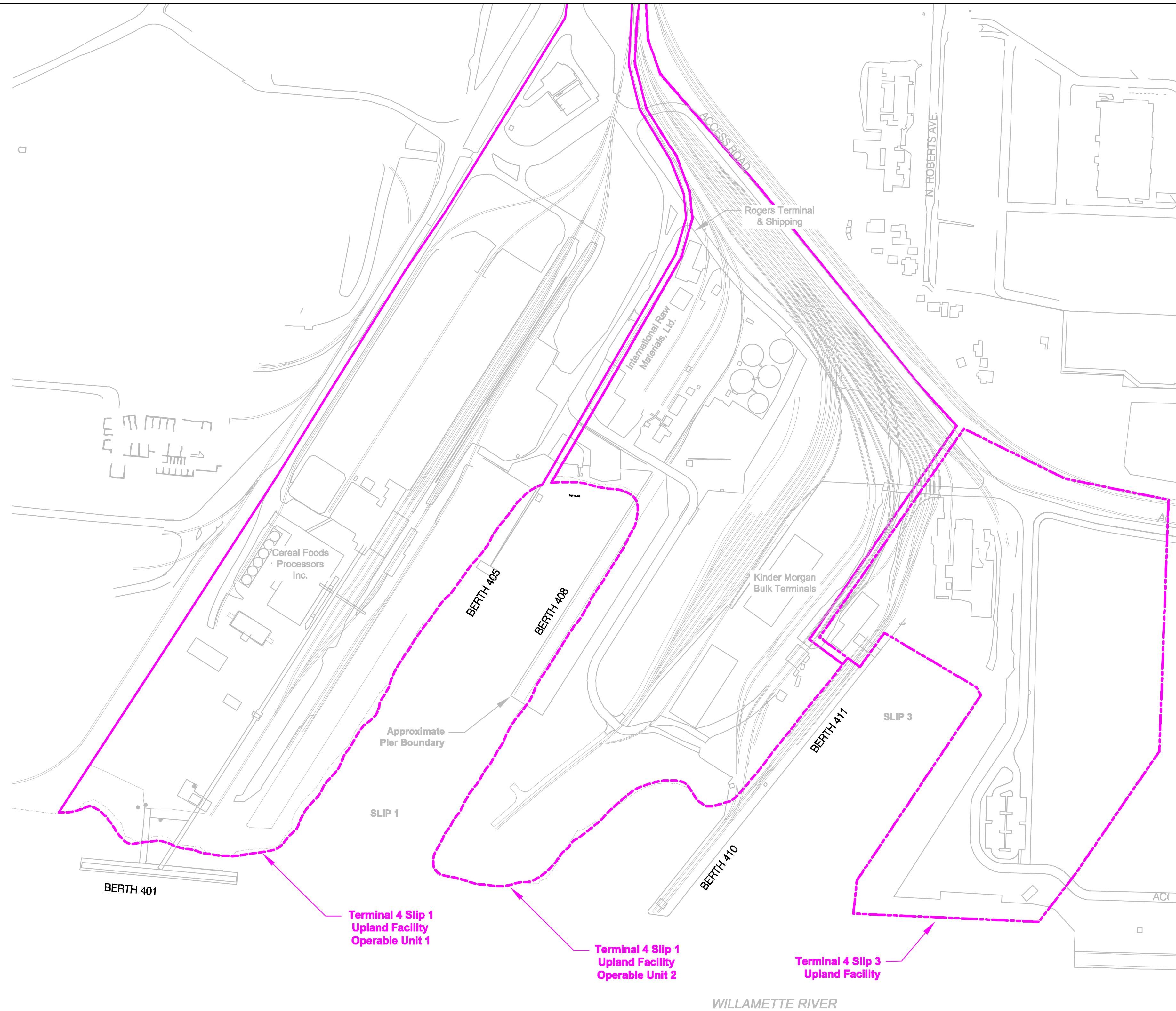
0 2,000 4,000

Approximate Scale in Feet

Facility Location Map

Additional Storm Water Sampling Work Plan
Terminal 4 Slip 1 Upland Facility
Portland, Oregon

Ash Creek Associates A Division of Apex Companies, LLC APEX	Project Number	1267	Figure
	August 2012		1



Legend:

- Slip 1 Operating Unit Boundary as Defined by Ordinary Low Water Level (1.7 Ft. CRD)
- Slip 1 Operating Unit Boundary - Upland
- Slip 3 Unit Boundary
- Terminal 4 Auto Storage Area

NOTES:

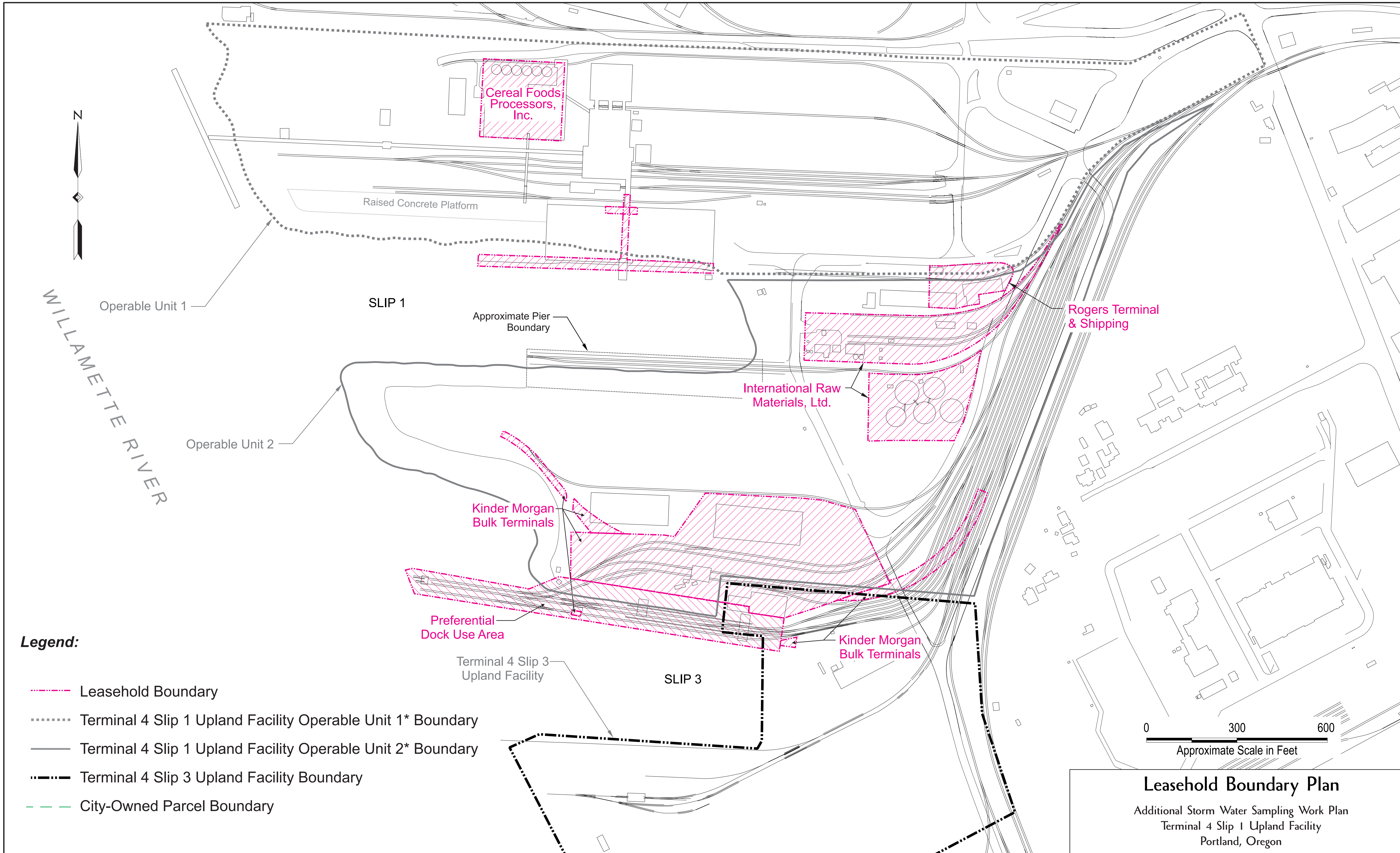
1. Base map prepared from Port of Portland AutoCAD file, dated 11/08.
2. Horizontal Datum: State Plane Coordinates, Oregon North, NAD 83. Vertical Datum: NVGD 29.
3. City outfall 52-C not shown.

Facility Plan

Additional Storm Water Sampling Work Plan
Terminal 4 Slip 1 Upland Facility
Portland, Oregon

Ash Creek Associates
A Division of Apex Companies, LLC
APEX

Project Number	1267	Figure
August 2012		2



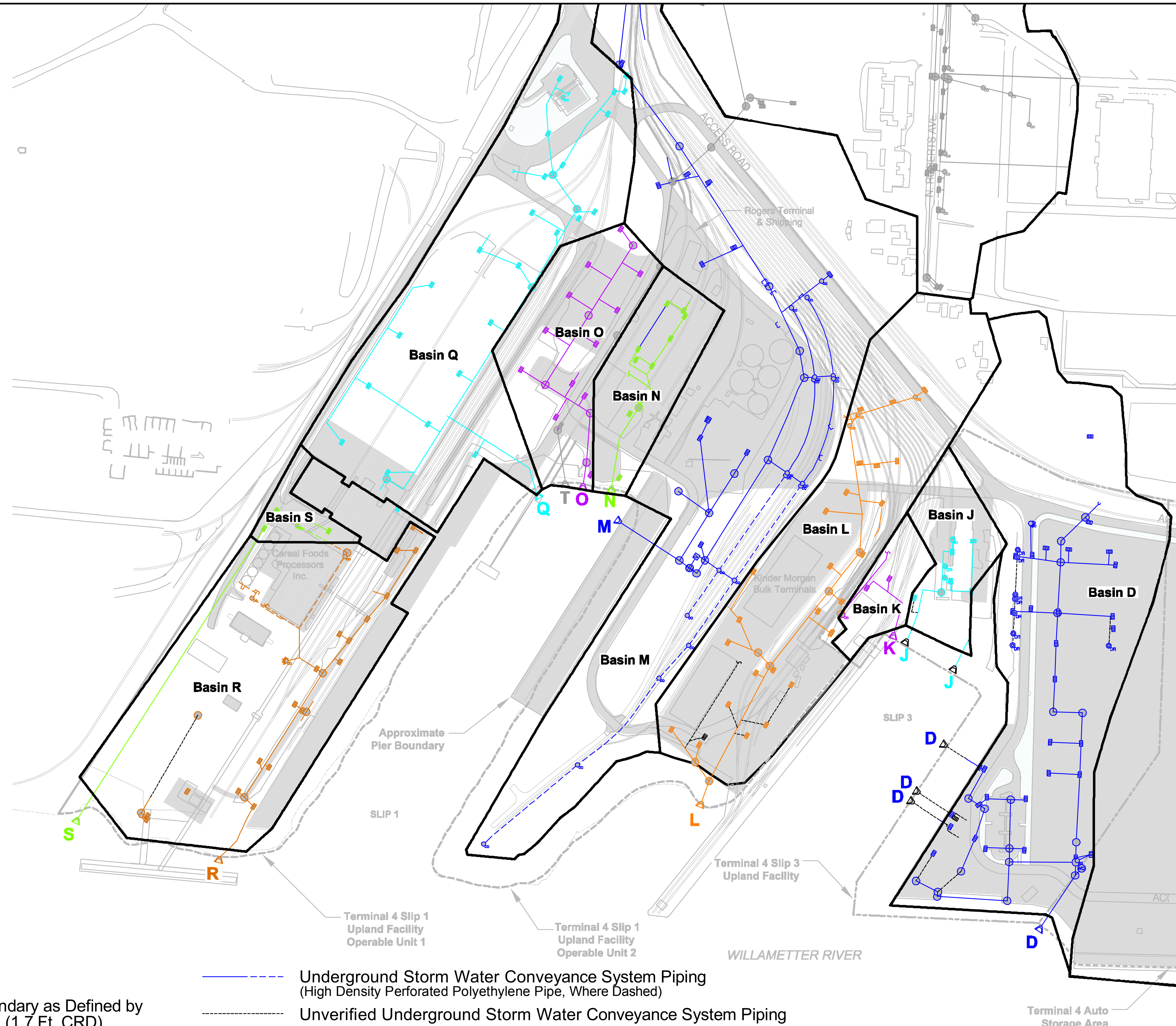
Notes: 1) Base map prepared from the URS Draft T4 Slip 1 RI Work Plan, dated May 2004.
2) Horizontal Datum: State Plane Coordinates, Oregon North, NAD 83. Vertical Datum: NVGD 29.
3) *The boundary with the Willamette River is defined by Ordinary Low Water Level (3.4 FT NGVD).

Leasehold Boundary Plan

Additional Storm Water Sampling Work Plan
Terminal 4 Slip 1 Upland Facility
Portland, Oregon

Ash Creek Associates
A Division of Apex Companies, LLC
APEX

Project Number	1267	Figure
August 2012		3



Legend:

- Drainage Basin Boundary
- Slip 1 Operating Unit Boundary as Defined by Ordinary Low Water Level (1.7 Ft. CRD)
- Slip 1 Operating Unit Boundary - Upland
- Slip 3 Unit Boundary
- Terminal 4 Auto Storage Area
- Asphalt or Concrete Pavement
- Underground Storm Water Conveyance System Piping (High Density Perforated Polyethylene Pipe, Where Dashed)
- Unverified Underground Storm Water Conveyance System Piping
- Stormfilter Treatment Vault
- Oil Water Separator
- Catch Basin
- Water Quality Manhole (Downstream Defender)
- Cleanout
- Drain
- Manhole
- Manhole/Catch Basin
- D Outfall with Basin Designation

NOTES:
1. Base map prepared from Port of Portland AutoCAD file, dated 11/08.
2. Horizontal Datum: State Plane Coordinates, Oregon North, NAD 83. Vertical Datum: NVGD 29.
3. City outfall 52-C not shown.

N

0 400 800

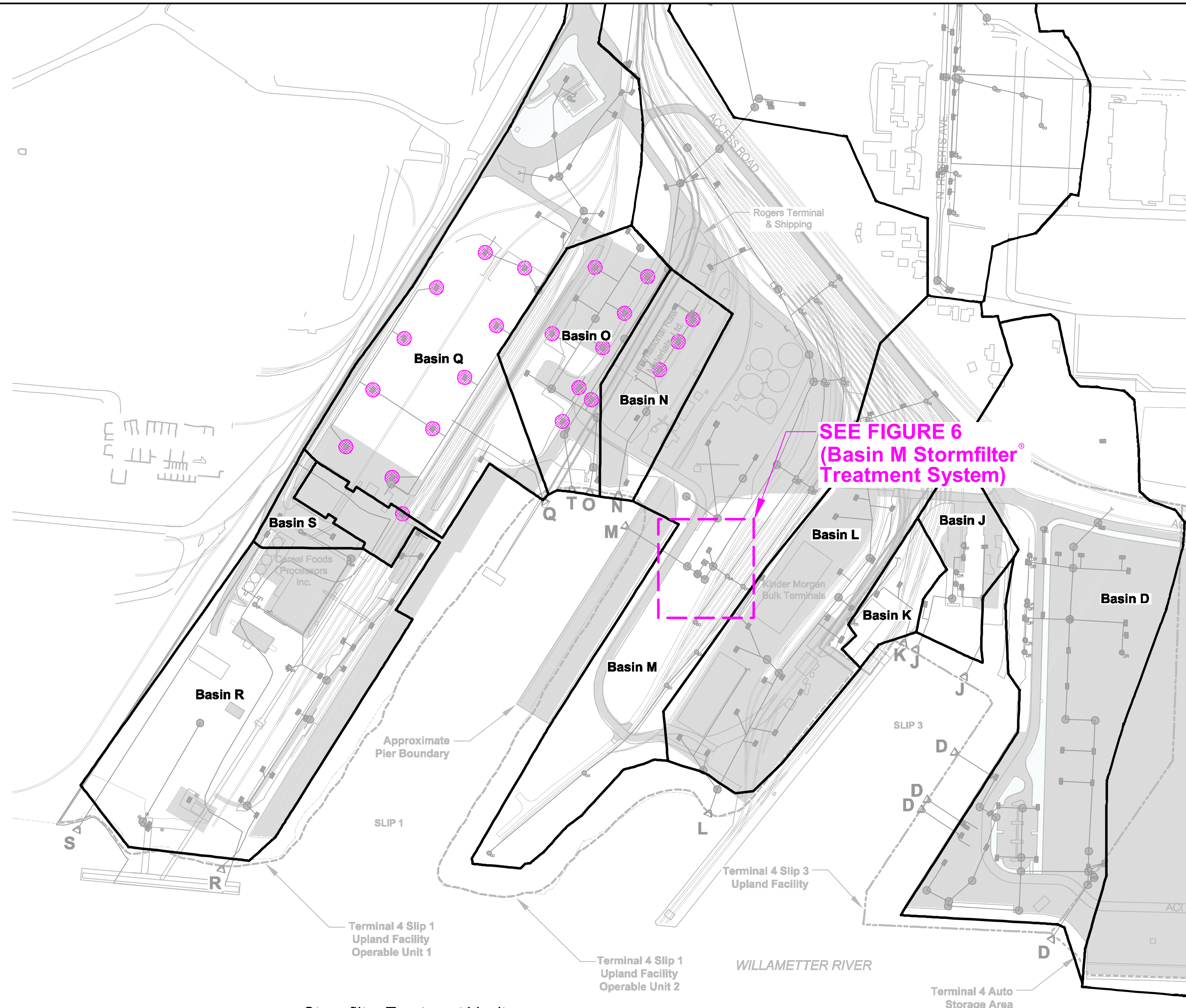
Scale in Feet

Storm Drain System and Drainage Basins

Additional Storm Water Sampling Work Plan
Terminal 4 Slip 1 Upland Facility
Portland, Oregon

Ash Creek Associates
A Division of Apex Companies, LLC
APEX

Project Number	1267	Figure
August 2012		4



Legend:

- Catch Basins with Inserts
- Drainage Basin Boundary
- Slip 1 Operating Unit Boundary as Defined by Ordinary Low Water Level (1.7 Ft. CRD)
- Slip 1 Operating Unit Boundary - Upland
- Slip 3 Unit Boundary
- Terminal 4 Auto Storage Area
- Asphalt or Concrete Pavement
- Stormfilter Treatment Vault
- Underground Storm Water Conveyance System Piping
- Oil Water Separator
- Catch Basin
- Water Quality Manhole (Downstream Defender)
- Cleanout
- Drain
- Manhole
- Manhole/Catch Basin
- D Outfall with Basin Designation

NOTES:
1. Base map prepared from Port of Portland AutoCAD file, dated 11/08.
2. Horizontal Datum: State Plane Coordinates, Oregon North, NAD 83. Vertical Datum: NVGD 29.
3. City outfall 52-C not shown.

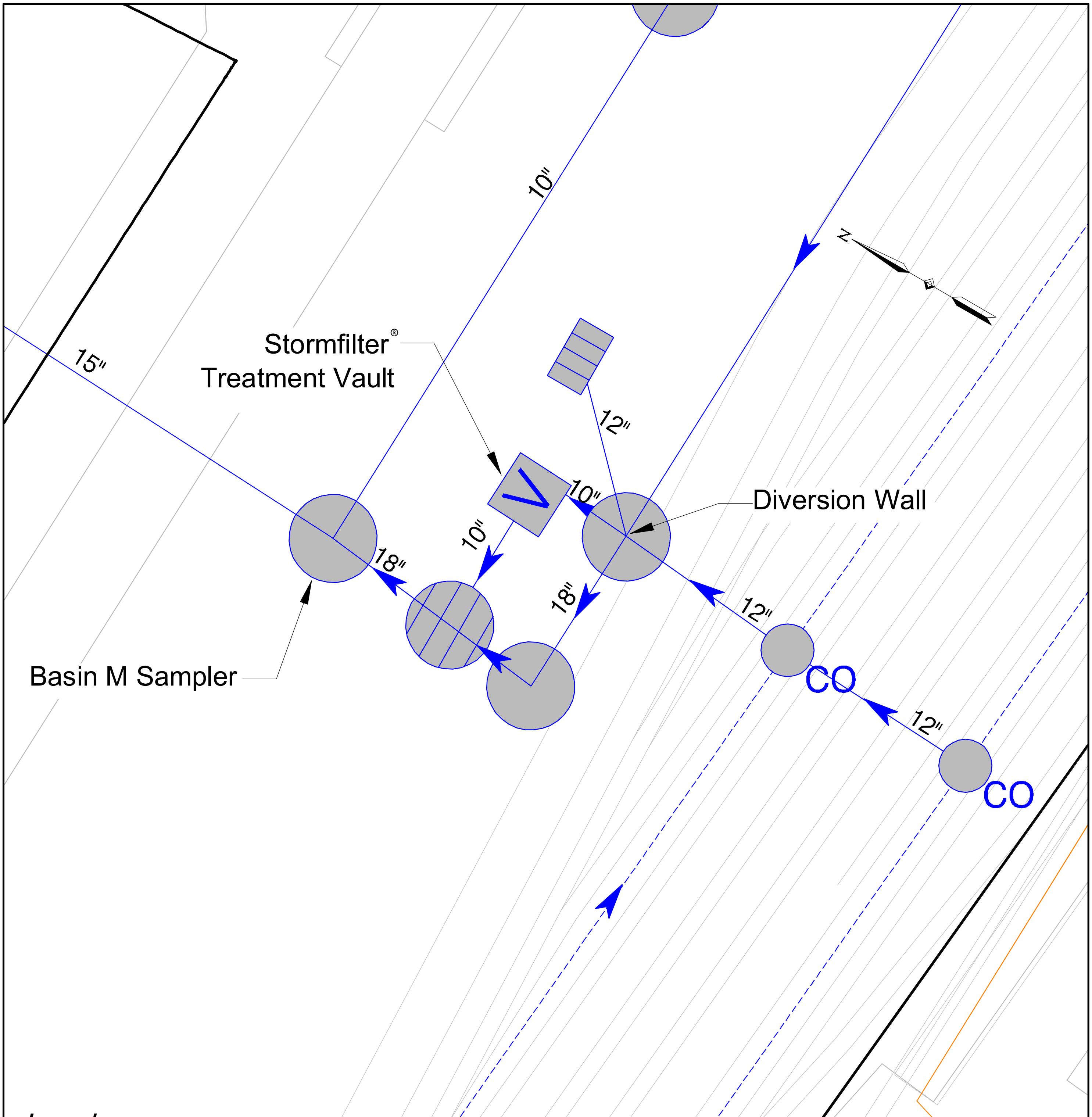
0 400 800
Scale in Feet

Storm Water Controls

Additional Storm Water Sampling Work Plan
Terminal 4 Slip 1 Upland Facility
Portland, Oregon

Ash Creek Associates
A Division of Apex Companies, LLC
APEX

Project Number	1267	Figure
August 2012		5



Legend:

→	Underground Storm Water Conveyance System Piping and Flow Direction
V	Stormfilter Treatment Vault
	Catch Basin
CO	Cleanout
	Manhole
	Manhole/Catch Basin

0 40 80
Scale in Feet

NOTES:

1. Base map prepared from Port of Portland AutoCAD file, dated 11/08.
2. Horizontal Datum: State Plane Coordinates, Oregon North, NAD 83. Vertical Datum: NVGD 29.

Basin M Stormfilter® Treatment System

Additional Storm Water Sampling Work Plan
Terminal 4 Slip 1 Upland Facility
Portland, Oregon

Ash Creek Associates
A Division of Apex Companies, LLC
APEX

Project Number	1267	Figure
August 2012		6

Legend:

- Basin Q — Storm Water Sampling Manhole Location
- Drainage Basin Boundary
- Slip 1 Operating Unit Boundary as Defined by Ordinary Low Water Level (1.7 Ft. CRD)
- Slip 1 Operating Unit Boundary - Upland
- Slip 3 Unit Boundary
- Terminal 4 Auto Storage Area
- Asphalt or Concrete Pavement
- Stormfilter Treatment Vault
- Underground Storm Water Conveyance System Piping
- Oil Water Separator
- Catch Basin
- Water Quality Manhole (Downstream Defender)
- Cleanout
- Drain
- Manhole
- Manhole/Catch Basin
- D ▷ Outfall with Basin Designation

NOTES:

1. Base map prepared from Port of Portland AutoCAD file, dated 11/08.
2. Horizontal Datum: State Plane Coordinates, Oregon North, NAD 83. Vertical Datum: NVGD 29.
3. City outfall 52-C not shown.

0 400 800

Scale in Feet

Proposed Storm Water Sampling Locations

Additional Storm Water Sampling Work Plan
Terminal 4 Slip 1 Upland Facility
Portland, Oregon

Ash Creek Associates
A Division of Apex Companies, LLC
APEX

Project Number	1267	Figure
August 2012		7

Appendix A

Sampling and Analysis Plan

Appendix A – Sampling and Analysis Plan

1.0 Introduction

This appendix presents the field and sampling procedures and the analytical testing program that will be used to complete the field and analytical work for this project. Quality assurance and quality control (QA/QC) procedures are also discussed in this appendix.

2.0 Field and Sampling Procedures

The scope of work (SOW) includes storm water sampling and chemical analysis. The field and sampling procedures include collection of composite storm water samples, sample management (i.e., containers, storage, and shipment), decontamination procedures, and handling of investigation-derived wastes (IDW).

2.1 Preparatory Activities

Site Health and Safety Plan. A Site-specific health and safety plan (HASP) will be prepared for the proposed activities in general accordance with the Occupational Safety and Health Act (OSHA) and the Oregon Administrative Rules (OAR). A copy of the HASP will be maintained on-site during the field activities.

2.2 Collection of Composite Storm Water Samples

Bulk storm water samples will be collected as composite samples, which comprise a number of discrete individual samples of specific volumes taken at flow-weighted or time-weighted intervals. An automatic composite sampler will be set up with an area velocity flow meter that activates the sampling when there is flow in the pipe. The storm water samplers for Basins L and M will be installed in relatively low traffic areas and consequently the samplers will likely be installed above ground (and covered with large wood boxes). The sampler will be programmed with the flow velocity for that specific pipe corresponding to the target rainfall event intensity. The Rational Method, in combination with Manning's equation and pipe geometry will be used to estimate flow velocity for the initial flow-weighting programming for the composite samplers. The Rational Method is a widely used method for estimating runoff of small drainage basins.[1] The Manning equation[2] and pipe geometry will be used to estimate the flow level and velocity expected in the storm water conveyance system within each basin based on the estimated runoff from a criteria storm.

---

[1] The rational method equation is: Q = kCiA where: Q – runoff flow; k – conversion constant; C - dimensionless runoff coefficient; i - rainfall intensity and A - catchment area.

[2] The Manning Equation was developed for uniform steady state flow in an open channel and is: $V = \frac{k}{n} R_h^{\frac{2}{3}} \cdot S^{\frac{1}{2}}$ where:

V is the cross-sectional average velocity; *k* is a conversion constant *n* is the Manning coefficient of roughness; R_h is the hydraulic radius;*S* is the slope of the water surface. The discharge formula, $Q = A\,V$, can be used to manipulate Manning's equation to compute flow knowing limiting or actual flow velocity.

The samplers will be programmed to fill individual 1-gallon bottles one at a time. The first bottle would be filled when the target flow is reached. Then, based upon the average storm duration and intensity, the sampler will be programmed to fill the remaining bottles throughout the storm event. The collected storm water from the four 1-gallon bottles will be composited and samples for chemical analysis will be collected from that composite. The storm water samples will be obtained from the same manholes where sampling was historically conducted.

2.3 Sample Management

Containers. Clean 1-gallon sample containers will be provided by the analytical laboratory ready for sample collection.

Labeling Requirements. A sample label will be affixed to each sample container before sample collection. Containers will be marked with the project number, a sample number, date of collection, and the sampler's initials.

Sample Storage and Shipment. Sample will be stored in a cooler chilled with ice or blue ice to 4 degrees Celsius (°C). The cooler lid will be sealed with chain-of-custody seals. If necessary, the samples will be sent via overnight courier to the analytical laboratory for chemical analysis. Otherwise, Ash Creek will transport the containers to the laboratory. Chain-of-custody will be maintained and documented at all times.

2.4 Decontamination Procedures

Personnel Decontamination. Personnel decontamination procedures depend on the level of protection specified for a given activity. The HASP will identify the appropriate level of protection for the type of work and expected field conditions associated with this project. In general, clothing and other protective equipment can be removed from the investigation area. Field personnel should thoroughly wash their hands and faces at the end of each day and before taking any work breaks.

Sampling Equipment Decontamination. To prevent cross-contamination between sampling events, clean, dedicated sampling equipment will be used when possible for each sampling event and will be discarded after use. Cleaning of non-disposable items will consist of washing in a detergent (Alconox®) solution, rinsing with tap water, followed by a deionized (DI) water rinse.

2.5 Handling of Investigation-Derived Waste

Disposable items, such as sample tubing, gloves, protective overalls (e.g., Tyvek®), paper towels, etc., will be placed in plastic bags after use and deposited in trash receptacles for disposal.

3.0 Analytical Testing Program

An analytical testing program will be performed to assess the chemical quality of samples collected as part of this project. Analytical laboratory QA/QC procedures are discussed in Section 4 of this appendix.

The laboratory-supplied method reporting limits (MRLs) and method detection limits (MDLs) are presented in Table A-1 along with the JSCS screening levels (DEQ/EPA, 2005). Samples will be collected and handled using methods described in Section 2 of this appendix.

The contaminants of interest (COI) and respective analytical methods that are anticipated for this project include:

- Total and dissolved polycyclic aromatic hydrocarbons by EPA Method 8270-SIM;
- Total and dissolved arsenic by EPA Method 1632; and
- Total suspended solids (TSS) by SM 2540D.

For the dissolved analyses, the LWG filtration protocols specify a 0.2-micron filtration for organics and 0.45-micron filtration for inorganics.

4.0 Quality Assurance Program

4.1 Quality Assurance Objectives for Data Management

The general QA objectives for this project are to develop and implement procedures for obtaining and evaluating data of a specified quality that can be used to assess the concentrations of PAHs, arsenic, and TSS. To collect such information, analytical data must have an appropriate degree of accuracy and reproducibility, samples collected must be representative of actual field conditions, and samples must be collected and analyzed using unbroken chain-of-custody procedures (see Section 4.3).

MDLs and analytical results will be compared to action levels for each parameter in media of concern. The detection limits listed in Table A-1 are the expected MDLs and MRLs, based upon laboratory calculations and experience.

Specific QA objectives are as follows:

- Establish sampling techniques that will produce analytical data representative of the media (e.g., storm water) being measured.

- Analyze a sufficient number of analytical duplicate samples to assess the performance of the analytical laboratory.
- Collect and analyze a sufficient number of blank samples to evaluate the potential for contamination from sampling equipment and techniques, and/or transportation.
- Analyze a sufficient number of blank, standard, duplicate, spiked, and check samples within the laboratory to evaluate results against numerical QA goals established for precision and accuracy.

Precision, accuracy, representativeness, completeness, and comparability parameters used to indicate data quality are defined below.

4.1.1 Precision

Precision is a measure of the reproducibility of data under a given set of conditions. Specifically, it is a quantitative measure of the variability of a group of measurements compared to their average value. For duplicate measurements, precision can be expressed as the relative percent difference (RPD). Field duplicates will not be collected. A 5-percent duplicate frequency will be carried out for laboratory samples.

4.1.2 Accuracy

Accuracy is the measure of error between the reported test results and the true sample concentration. True sample concentration is never known due to analytical limitations and error. Consequently, accuracy is inferred from the recovery data from spiked samples.

Because of difficulties with spiking samples in the field, the laboratory will spike samples. The laboratory shall perform sufficient spike samples of a similar matrix to allow the computation of the accuracy. For analyses of less than five samples, matrix spikes may be performed on a batch basis.

Perfect accuracy is 100 percent recovery.

4.1.3 Representativeness

Representativeness is a measure of how closely the results reflect the actual concentration of the chemical parameters in the medium sampled. Sampling procedures—as well as sample-handling protocols for storage, preservation, and transportation—are designed to preserve the representativeness of the samples collected. Proper documentation will confirm that protocols are followed. This helps to assure sample identification and integrity.

Laboratory method blanks will be run in accordance with established laboratory protocols to ensure samples are not contaminated during sample preparation in the laboratory.

4.1.4 Completeness

Completeness is defined as the percentage of measurements made which are judged to be valid. The completeness goal is essentially that a sufficient amount of valid data be generated to meet the closure requirements.

4.1.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. The objective of this QA program is to assure that all data developed during the investigation are comparable. Comparability of the data will be assured by using EPA-defined procedures which specify sample collection, handling, and analytical methods. The comparability of past data will be evaluated during the investigation (if possible) by assessing the techniques used for sample collection and analysis.

4.1.6 Documentation

Essentially, EPA Level III documentation will be generated during this investigation. This level of documentation is generally considered legally defensible and consists of the following:

- Holding times
- Trip blank data
- Field duplicate data
- Rinse blank data
- Laboratory method blank data
- Sample data
- Matrix/surrogate spike data
- Duplicate sample data

4.2 Sampling Procedures

Sampling procedures for storm water are presented above in Section 2 of this appendix. These procedures are designed to ensure:

- Samples collected at the site are consistent with project objectives; and
- Samples are identified, handled, and transported in a manner that does not alter the representativeness of the data from the actual site conditions.

QA objectives for sample collection will be accomplished through a combination of the following items:

- Trip Blank. No trip blanks are planned for the storm water sampling program as there are no planned analyses for volatile organic compounds (VOCs).
- Rinse Blank Sample. No rinse blanks are planned for the storm water sampling program as there will be dedicated tubing and laboratory-supplied containers.
- Duplicate Samples. No field duplicates are planned for the storm water sampling program.
- Laboratory QA. Laboratory duplicate measurements will be carried out on at least 10 percent of laboratory samples. Analytical procedures will be evaluated using the protocols of the analytical laboratory. These protocols can be submitted upon request.

4.3 Sample and Document Custody Procedures

The various methods used to document field sample collection and laboratory operation are presented below.

4.3.1 Field Chain-of-Custody Procedures

Sample chain-of-custody refers to the process of tracking the possession of a sample from the time it is collected in the field through the laboratory analysis. A sample is considered to be under a person's custody if it is:

- In a person's physical possession;
- In view of the person after possession has been taken; or
- Secured by that person so no one can tamper with the sample, or secured by that person in an area restricted to authorized personnel.

A chain-of-custody form is used to record possession of a sample and to document analyses requested. Each time the sample bottles or samples are transferred between individuals, both the sender and receiver sign and date the chain-of-custody form. When a sample shipment is transported to the laboratory, a copy of the chain-of-custody form is included in the transport container (e.g., ice chest).

The chain-of-custody forms are used to record the following information:

- Sample identification number
- Sample collector's signature
- Date and time of collection
- Description of sample

- Analyses requested
- Shipper's name and address
- Receiver's name and address
- Signatures of persons involved in chain-of-custody

4.3.2 Laboratory Operations

The analytical laboratory has a system in place for documenting the following laboratory information:

- Calibration procedures
- Analytical procedures
- Computational procedures
- Quality control procedures
- Bench data
- Operating procedures or any changes to these procedures
- Laboratory notebook policy

Laboratory chain-of-custody procedures provide the following:

- Identification of the responsible party (sample custodian) authorized to sign for incoming field samples and a log consisting of sequential lab tracking numbers.
- Specification of laboratory sample custody procedures for sample handling, storage, and internal distribution for analysis.

4.3.3 Corrections to Documentation

Original data are recorded in field notes and on chain-of-custody forms using indelible ink. Documents will be retained even if they are illegible or contain inaccuracies that require correction.

If an error is made on a document, the individual making the entry will correct the document by crossing a line through the error, entering the correct information, and initialing and dating the correction. Any subsequent error discovered on a document is corrected, initialed, and dated by the person who made the entry.

4.4 Equipment Calibration Procedures and Frequency

Instruments and equipment used during this project will be operated, calibrated, and maintained according to the manufacturer's guidelines and recommendations. Operation, calibration, and maintenance will be performed by laboratory personnel fully trained in these procedures.

4.5 Analytical Procedures

Samples will be analyzed using essentially SW 846 analytical protocols for the parameters identified above in Section 2 of this appendix.

4.6 Data Reduction, Validation, and Reporting

Reports generated in the field and laboratory will be included as an appendix to the draft and final versions of the Data Summary Report.

The task manager will assure validation of the analytical data. The laboratory generating analytical data for this project will be required to submit results that are supported by sufficient backup and QA/QC data to enable the reviewer to determine the quality of the data. Validity of the laboratory data will be determined based on the objectives outlined in Section 4.1 - Quality Assurance Objectives for Data Management. Data validity will also be determined based upon the sampling procedures and documentation outlined in Sections 4.2 and 4.3 of this Sampling and Analysis Plan (SAP). Upon completion of the review, the task manager will be responsible for assuring development of a QA/QC report on the analytical data. Data will be stored and maintained according to the standard procedures of the laboratory. The method of data reduction will be described in the final report.

4.7 Performance Audits

Performance audits are an integral part of an analytical laboratory's SOPs and are available upon request.

4.8 Corrective Actions

If the QC audit detects unacceptable conditions or data, the project manager will be responsible for developing and initiating corrective action. The task manager will be notified if the nonconformance is significant or requires special expertise. Corrective action may include the following:

- Reanalyzing the samples, if holding time criteria permit;
- Resampling and analyzing;
- Evaluating and amending sampling and analytical procedures; and
- Accepting data and acknowledging level of uncertainty or inaccuracy by flagging the data.

4.9 Quality Assurance Reports

The task manager will prepare a QA/QC evaluation of the data collected during the Site investigation field activities for inclusion in the final report. In addition to an opinion regarding the validity of the data, the QA/QC evaluation will address the following:

- Any adverse conditions or deviations from this SAP.
- Assessment of analytical data for precision, accuracy, and completeness.
- Significant QA problems and recommended solutions.
- Corrective actions taken for any problems previously identified.

Table A-1 – Reporting Limits
Terminal 4 Slip 1 Upland Facility
Portland, Oregon

Analyte	Units	MDL	MRL	JSCS
Total Suspended Solids (TSS) by method SM2540 D				
TSS	mg/L	1	1	--
Metals (EPA Method 1632)				
Arsenic	ug/L	0.003	0.02	0.045
Polycyclic Aromatic Hydrocarbons (EPA Method 8270-SIM)				
Acenaphthene	ug/L	0.0004	0.0034	0.2
Acenaphthylene	ug/L	0.0004	0.0034	0.2
Anthracene	ug/L	0.0003	0.0034	0.2
Benz(a)anthracene	ug/L	0.0003	0.0034	0.018
Benzo(a)pyrene	ug/L	0.0004	0.0034	0.018
Benzo(b)fluoranthene	ug/L	0.0003	0.0034	0.018
Benzo(g,h,i)perylene	ug/L	0.0004	0.0034	0.2
Benzo(k)fluoranthene	ug/L	0.0004	0.0034	0.018
Chrysene	ug/L	0.0007	0.0034	0.018
Dibenz(a,h)anthracene	ug/L	0.0005	0.0034	0.018
Fluoranthene	ug/L	0.0005	0.0034	0.2
Fluorene	ug/L	0.0004	0.0034	0.2
Indeno(1,2,3-cd)pyrene	ug/L	0.0004	0.0034	0.018
Naphthalene	ug/L	0.0007	0.0034	0.2
Pyrene	ug/L	0.0008	0.0034	0.2

Notes:
1. -- = Not available or not applicable.
2. MDL = Method detection limit (MDL).
3. MRL = Method reporting limit (MRL).
4. JSCS = Screening levels from Portland Harbor Joint Source Control Strategy – Final (Table 3-1 Updated July 16, 2007). December 2005